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Prototype design and performance test of a cosmic ray tracker

The High energy cosmic-Radiation Detection(HERD)[1,2] facility has been proposed as one of several space astronomy payloads onboard the future China's Space Station(CSS), which is planned for operation starting around 2026 for about 10 years. A cosmic ray tracker with position resolution of better than 1mm and effective detection area of 1m*1m is designed to do detector performance study.*
*The cosmic ray tracker will consist of two tracking stations each with two detection planes. Each detection plane will have 10 SciFi modules, placed in parallel next to each other constituting a 1m*1m detection surface. The modules contain 1m long scintillating fibers with a diameter of 1mm which are arranged 10cm wide and 1m long fiber-mats of 3 staggered layers of fibers. The fibers will be read out by arrays of SiPMs with a channel widths of 1mm and a channel height of 3mm. An epoxy loaded with TiO2 is used to glue fibers together and block inter-fiber crosstalk. To increase the number of scintillation photons detected by the SiPMs the fiber end of the detector is covered with ESR reflector to reflect the light towards the readout ends. The readout board mounted with SiPMs are precisely positioned with respect to the fiber ends. The precise SiPMs mounting on the fiber matrix will provide the position of the through-going cosmic ray.
The performance of a small prototype module was tested with cosmic ray and radioactive source 90-Sr. The measured light output of the 3-layer fiber module is around 10 p.e. per MIP events.

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